# Upload Assignment: Assignment 6.1



## ASSIGNMENT INFORMATION

| Due Date | Points Possible |
|---|---|
| **Monday, November 8, 2021** 11:59 PM | **0.5** View Rubric |

### PRIMMAL FORMULATION OF A NONLINEAR CLASSIFIER WITH MMSE

Use the attached function to reconstruct the example of lesson 6.1. In particular, you must:

1) Construct a train dataset and represent them. Your representation may be rotated 90º with respect to the one of the slides.

2)  Construct a function to directly map the data into a 10 dimension Hilbert space using the Volterra expansion.

3) Compute the weights of the MMSE solution, and represent  the boundary as indicated in the slides.

Provide a document that summarizes the theory and a graph of the result. Comment your results.

MATLAB CODE

```
[X,y]=data(100,0.2)

i1=find(y==1);
i2=find(y==-1);
figure(1)
plot(X(1,i1),X(2,i1),'s')
hold on
plot(X(1,i2),X(2,i2),'r*')
xlabel('x[n-1]')
ylabel('x[n]')

function [X,y]=data(N,a)
N=N+1;
y=sign(randn(1,N));
x=filter([1 a],1,y)+0.2*randn(size(y));
X=buffer(x,2,1,'nodelay'); %Convolution
y=y(2:end)
end
```

PYTHON CODE

```
import numpy as np #nummerical tools
import scipy.signal as sp #signal processing tools
import matplotlib.pyplot as plt
def data(N,a):
    N=N+3
    h=np.array([1,a])
    y=np.sign(np.random.randn(N,1))
    y=np.reshape(y,len(y))
    t=np.arange(N)
    z=np.convolve(h,y)
    z=z[1:N-1]
    y=y[2:N-1]
    X=np.array([z[0:N-3],z[1:N-2]])+0.2*np.random.randn(2,N-3)
    return X,Y

X,y=data(100,0.2)

ind1=np.where(y==1)
ind2=np.where(y==-1)
plt.plot(X[0,ind1],X[1,ind1],'b*')
plt.plot(X[0,ind2],X[1,ind2],'r*')
plt.xlabel('x[n-1]')
plt.ylabel('x[n]')
plt.show()
```